LARGE ARCHIBENTHAL GASTROPODS OF CENTRAL CHILE: COLLECTIONS FROM AN EXPEDITION OF THE R/V ANTON BRUUN AND THE CHILEAN SHRIMP FISHERY[1]

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ABSTRACT. Fifteen species of large gastropods from off central Chile collected both by an expedition of the R/V ANTON BRUUN in 1966 and by commercial trawling for the shrimp *Heterocarpus reedi* are treated. Nine previously described species are reviewed: *Bathybembix macdonaldi, B. humboldti, Calliostoma chilena, Capulus ungaricoides, Fusitriton magellanicus, Aeneator fontainei, A. loisae, Miomelon alarconi*, and *Ptychosyrinx chilensis*. Six species are described as new: *Diodora codoceoae, Calliostoma delli, Trophon bahamondei, Columbarium tomicici, Aeneator castillai*, and *Cancellaria stuardoi*.

RESUMEN. Se estudiaron quince especies de macrogastropodos obtenidos en faenas de pesca camaronera por arrastre y por la expedicion del B/I ANTON BRUUN en la zona central de Chile. De estas, nueve especies habian sido ya descritas y se hace la revision de cada una de ellas: *Bathybembix macdonaldi, B. humboldti, Calliostoma chilena, Capulus ungaricoides, Fusitriton magellanicus, Aeneator fontainei, A. loisae, Miomelon alarconni* y *Ptychosyrinx chilensis*. Las seis restantes son consideradas como nuevas y se entregan sus descripciones: *Diodora codoceoae, Calliostoma delli, Trophon bahamondei, Columbarium tomicici, Aeneator castillai* y *Cancellaria stuardoi*.

INTRODUCTION

The marine invertebrate fauna of the lower continental shelf and slope off central Chile is poorly known. This region is one of the few areas of the world not covered by the great expeditions of the last century. In recent years, however, collections from two sources have become available. An expedition of the R/V ANTON BRUUN sampled the region in 1966, and, in subsequent years, the shrimp fishery for *Heterocarpus reedi* Bahamonde, 1955, has yielded abundant material of the larger species.

Over the last 14 years, six mollusks commonly taken by the shrimp fishery have been described from central Chile: Berry (1968) described *Ptychosyrinx chilensis*; Rehder (1971) described *Limopsis ruizana, Bathybembix humboldti, Calliostoma chilena*, and *Aeneator loisae*; Stuardo and Villarroel (1974) described *Miomelon alarconi*. Other new species have been recognized by marine biologists in Chile but have remained undescribed until now.

From 1976 through 1980, Andrade obtained extensive material of mollusks and other invertebrates incidental to the shrimp fishery. Specimens were saved by crew members of the trawling vessel GODEN WIND and other vessels based in Quintero. These vessels worked the Chilean coastline to the north and south of Valparaiso between Los Vilos (31°56′S) and Constitución (35°20′S).

The following contributions treating the echinoderms and crustaceans from the Chilean shrimp fishery have been published: Andrade (1980), Andrade and Baez (1977, 1980), Baez and Andrade (1977, 1979), Codoceo and Andrade (1978, 1980, in press), Codoceo et al. (1978), Revuelta and Andrade (1978).

The offshore fauna of northern Peru has been sampled by expeditions of the ANTON BRUUN and by expeditions conducted by the Instituto del Mar, Callao, Peru. These expeditions have produced specimens of some of the species known from central Chile. The Peruvian records of these species are given in this paper.

The present paper is limited to the large gastropods of central Chile that have been taken by the shrimp fishery. Nine previously described species are reviewed, and six additional species are described. For most of the species, we have included a photograph of the radular ribbon as an aid in identification. Full discussion of radular features is beyond the scope of this paper. A more detailed study of radular structure would require the use of scanning electron microscopy.

OCEANOGRAPHIC CONDITIONS OFF CENTRAL CHILE

Depths of samples reported on here from off central Chile are archibenthal, corresponding to the upper part of the continental slope. The benthic fauna is mainly under the influence of Antarc-

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tic Intermediate Water and to a lesser degree of the overlaying Equatorial Subsurface Water, as discussed by Andrade and Baez (1980). Detailed accounts of the physical and chemical properties of the water masses in central Chile are given by Sievers and Silva (1975) and Silva and Sievers (1981).

MATERIALS AND STATION DATA

Station data for the collections reported in this paper are given in Table 1. Localities and depths for material from the shrimp fishery are necessarily less accurate than data for material collected by scientific expeditions. Depths and coordinates are not repeated in the text, except for type localities of the new species. For lots that define the northern and southern records, the corresponding latitudes are given in the distribution heading.

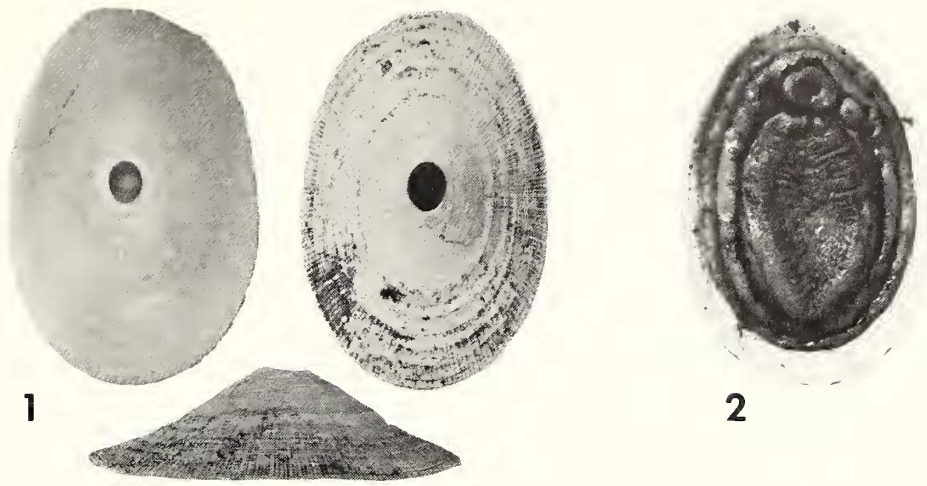
Abbreviations of museums mentioned in the text are as follows: BM(NH), British Museum (Natural History); LACM, Los Angeles County Museum of Natural History, Los Angeles, California, U.S.A.; MNHN, Museo Nacional de Historia Natural, Santiago, Chile; MZICB, Instituto Central de Biologia, Universidad de Concepción, Concepción, Chile; USNM, United States National Museum of Natural History, Washington, D.C., U.S.A. Type material of the six new species described herein is distributed among these institutions.

Collections upon which this report is based have been obtained from four sources:

Table 1. ANTON BRUUN, SNP-1, and Chilean shrimp fishery stations arranged north to south.

	Location		Depth (m)
PERU			
W of Lobos de Tierra, SNP-1, sta. 26	06 26 S	81 05 W	1,025
S of Lobos de Tierra, SNP-1, sta. 25	06 42	80 59	785
S of Lobos de Afuera, SNP-1, sta. 13	07 07	80 46	1,200
N of Isla Macabi, SNP-1, sta. 28	07 44	80 30	750–760
W of Isla Macabi, ANTON BRUUN, sta. 754	07 49	80 38	605–735
CHILE			
Junquillar, ANTON BRUUN, sta. 714	25 00	70 40	950
Punta Mar Brava, ANTON BRUUN, sta. 710	29 21	71 25	65–95
Punta Hornos, ANTON BRUUN, sta. 709	29 38	71 21	110
Coquimbo, trawler not identified*	29 58	—	200–400
Los Vilos, GODEN WIND	31 56	71 54	240–400
Pichidanqui, GODEN WIND	32 08	71 54	300–400
Punta Salinas, ANTON BRUUN, sta. 703	32 09	71 43	960
Caleta Molles, ANTON BRUUN, sta. 702	32 17	71 40	580
Papudo, GODEN WIND	32 31	71 54	200–350
Zapallar, GODEN WIND	32 33	71 43	350–450
Quintero, GODEN WIND	32 42	71 48	200–280
Algarrobo, trawler not identified	33 22	71 55	360
Punta Penablanca, ANTON BRUUN, no sta.	33 22	71 54	260–280
Punta Panulcillo, ANTON BRUUN, sta. 701	32 32	71 35	180–175
Puerto San Antonio, ANTON BRUUN, sta. 699	33 39	72 10	1,170–1,480
Punta Toro, trawler not identified	33 06	72 03	270
Bahia Navidad, ANTON BRUUN, sta. 686	33 58	72 05	140
Topocalma, trawler not identified	34 06	72 14	180–360
Punta Topocalma, ANTON BRUUN, sta. 687	34 07	72 19	750–730
Pichilemu, trawler not identified	34 27	72 24	240–350
Mataquito, trawler not identified	35 01	72 10	300
Constitucion, trawler not identified	35 20	72 55	260
Cabo Carranza, ANTON BRUUN, sta. 697	35 27	73 01	290–450

*For Coquimbo only, the locality refers to the home port, not the actual station, which is unknown.



Figures 1 and 2, *Diodora codoceoae* new species. **Figure 1,** three views of holotype, LACM 1979, 260 m off Constitución, Chile, length 40.7 mm. **Figure 2,** LACM 72485, 360 m off Topocalma, Chile, Length 40.6 mm.

1. Cruises of the ANTON BRUUN in Peru and Chile during 1966. This material is deposited in the LACM and USNM.

2. A cruise of the Peruvian naval vessel SNP-1 to the vicinity of the Lobos Islands in northern Peru in January 1974 on which McLean was present. Material from that cruise is deposited in the LACM and the Instituto del Mar, Callao, Peru.

3. Shrimp trawling localities (GODEN WIND and other vessels) in central Chile, 1977–1980. McLean visited the Montemar Marine Laboratory of the Universidad de Valparaíso in August 1978 and examined all of the collections then received by Andrade. This material is now deposited in the LACM, the MNHN, and the Museo Comparativo, Instituto de Oceanología, Universidad de Valparaíso.

4. Shrimp trawling vessels based in Coquimbo, Chile, 1964–1975; collections deposited at LACM by the late Harvey McMillin, Luis Ferreira Osses, and Jorge Tomicic K. In some cases, Coquimbo (29°58′S) is cited as the northern range limit of a species, although it should be understood that the actual occurrence for such a record could have been either to the north or south of Coquimbo.

SYSTEMATIC ACCOUNT

Superfamily Fissurellacea

Family Fissurellidae

Subfamily Diodorinae

Genus *Diodora* Gray, 1821

Type species (monotypy): *Patella apertura* Montagu, 1803 (= *P. graeca* Linnaeus, 1758). Recent, Europe.

Diodora species occur in most temperate and tropical regions of the world in intertidal, sublittoral, and, less frequently, archibenthal depths. Although there is considerable diversity of form among the species, an adequate subgeneric classification has never been offered.

Diodora codoceoae new species

Figures 1–3

DESCRIPTION. Shell large for the genus, thin, conical, basal outline elongate-oval, anterior end slightly narrower than posterior, basal margin lying flat, with ends slightly elevated. Lateral slopes straight, anterior and posterior slopes slightly concave. Foramen nearly central, oval, length of foramen about 10% of shell length, highest point of shell at the posterior rim of the foramen. Periostracum thin, brown, worn away over most of the surface; underlying surface chalky, worn near summit. Sculpture of numerous fine radial ribs; under magnification, the ribs are rounded, broader than the interspaces, crossed by raised growth lamellae to give a minute beaded appearance; primary ribs remain stronger so that every fourth rib is slightly more prominent than the others. Interior chalky white, the margin finely crenulated and grooved by the ribs; position of the stronger primary ribs marked by corresponding internal grooves. Under magnification, the crossed-lamellar aragonitic structure near the margin is visible. Muscle scar weakly discernible. Callus surrounding the foramen has an oval outline and is slightly truncated and depressed at its posterior edge. Thickness of shell at summit (depth of foramen) approximately equal to the width of the internal callus.

Dimensions: length 40.7 mm, width 27.0 mm, height 11.4 mm (holotype, Fig. 1); length 40.6 mm, width 26.9 mm, height 13.7 mm (Fig. 2).

Animal of preserved specimen (Fig. 2): colorless except for darkly pigmented eyes; contracted to fit completely within the shell; uppermost fold of mantle with a very finely scalloped edge, surface of the mantle folds and the foot sides with negligible development of papillae; cephalic tentacles and epipodial tentacles well developed.

Radula (Fig. 3): typical of the genus, laterals four, rachidian three times wider than the adjacent laterals; first marginal bicuspid as in other species of *Diodora*.

MATERIAL. Chile: Pichidanqui, Zapallar, Topocalma (LACM, Fig. 2), Constitución (LACM, holotype, Fig. 1). Specimens examined: 15.

TYPE MATERIAL. Three specimens from the type locality, collected 25 March 1976, by Andrade, shrimp trawler GODEN WIND. Holotype, LACM 1979; one paratype MNHN 200488, one paratype MZICB 15.527.

TYPE LOCALITY. 260 m off Constitucion, Chile (35°20′S, 72°55′W).

DISTRIBUTION. Pichidangui (34°06′S) to Constitución, Chile (35°20′S). Depth range 180–360 m.

DIAGNOSIS. A species of *Diodora* characterized by its large size, thin shell, oval aperture, and numerous radial ribs. It most resembles *D. tanneri* (Verrill, 1883), known from archibenthal depths in the western North Atlantic, from Delaware to the Caribbean (see Perez-Farfante, 1943:19). *D. codoceoae* differs in having a less conical profile, a proportionately larger foramen, and a more chalky shell surface. We have no information about the animal of *D. tanneri*. *Diodora codoceoae* also resembles *Stromboli beebei* (Hertlein and Strong, 1951), an offshore species in the tropical Panamic Faunal Province ranging from the Gulf of California to Ecuador (see McLean *in* Keen, 1971:318, fig. 29). Unlike *D. codoceoae*, *S. beebei* has a fleshy mantle that fully envelops the edge of the shell and radial ribs that are uniformly fine, with no distinction between primary and secondary ribs; in addition, *S. beebei* has a sturdier shell than that of *D. codoceoae*.

REMARKS. The internal callus surrounding the foramen is curved on the posterior side in *D. codoceoae*, *D. tanneri*, and *S. beebei*, not straight-edged as in most species of *Diodora*. However, this is a variable feature among species of *Diodora*, particularly those with oval foramena.

ETYMOLOGY. We are pleased to name this species in honor of Prof. Maria Codoceo of the Museo Nacional de Historia Natural, Santiago.

Superfamily Trochacea

Family Trochidae

Subfamily Eucyclinae

Genus *Bathybembix* Crosse, 1893

Type species (original designation): *Bembix aeola* Watson, 1879. Recent, Japan.

Bathybembix species are large mud-ingesting trochids occurring on the outer continental shelf and slope (Merriman, 1967; Hickman, 1981). They are members of the subfamily Eucyclinae, which appeared in the Mesozoic. Such recent genera as *Bathybembix* Crosse, 1893, *Calliotropis* Seguenza, 1903, and *Cidarina* Dall, 1909, have been recognized as members of the same group (McLean, 1981:335).[4]

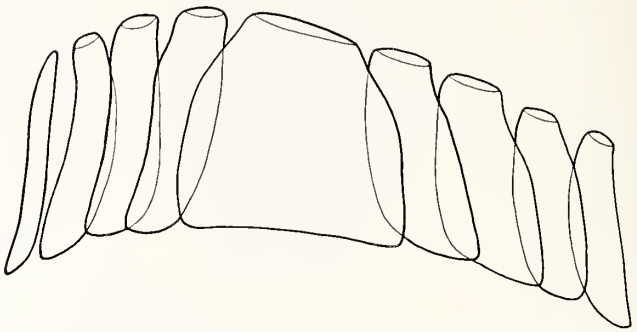


Figure 3, *Diodora codoceoae* new species, radular dentition of holotype, rachidian and lateral teeth, maximum dimension 0.8 mm.

The genus *Bathybembix* occurs in the northern Pacific, with several species in Japan, and one, *B. bairdii* (Dall, 1889), in the northeastern Pacific ranging from the Bering Sea, Alaska, to the Gulf of Tehuantepec, Mexico (McLean *in* Keen, 1971:331, fig. 62). The two species treated here are common off the coasts of both Peru and Chile. These species are members of the same typical subgenus in which the shells are large, the umbilicus closed, and the periostracum thick and colored greenish brown.

Bathybembix macdonaldi (Dall, 1890)

Figures 4–6

Turcicula macdonaldi Dall, 1890:348, pl. 7, fig. 7; 1908:349, pl. 19, fig. 7.

Bathybembix macdonaldi, McLean *in* Keen, 1971:331, fig. 63.

DESCRIPTION. Shell large, thin, high-spired; final whorl rounded, early whorls strongly carinate. Periostracum thin, yellowish or greenish brown. Protoconch missing, teleoconch whorls eight on intact specimens; early whorls often eroded. Spiral sculpture of two cords per whorl, a prominent projecting peripheral cord, with short projecting spines, and another weaker, noded cord just below the suture, becoming weaker and disappearing on the final whorl. Base with prominent spiral cords. Axial sculpture lacking except for fine growth increments on the periostracum. Outer lip thin, interior nacreous; operculum large, multispiral.

Dimensions: height 69.3 mm, diameter 49.0 mm (Fig. 4); height 75 mm, diameter 60 mm (holotype, Fig. 5).

Radula (Fig. 6): rachidian tooth broadly flanged, overhanging tip bearing numerous fine serrations along the sides; lateral teeth three, marginal teeth numerous.

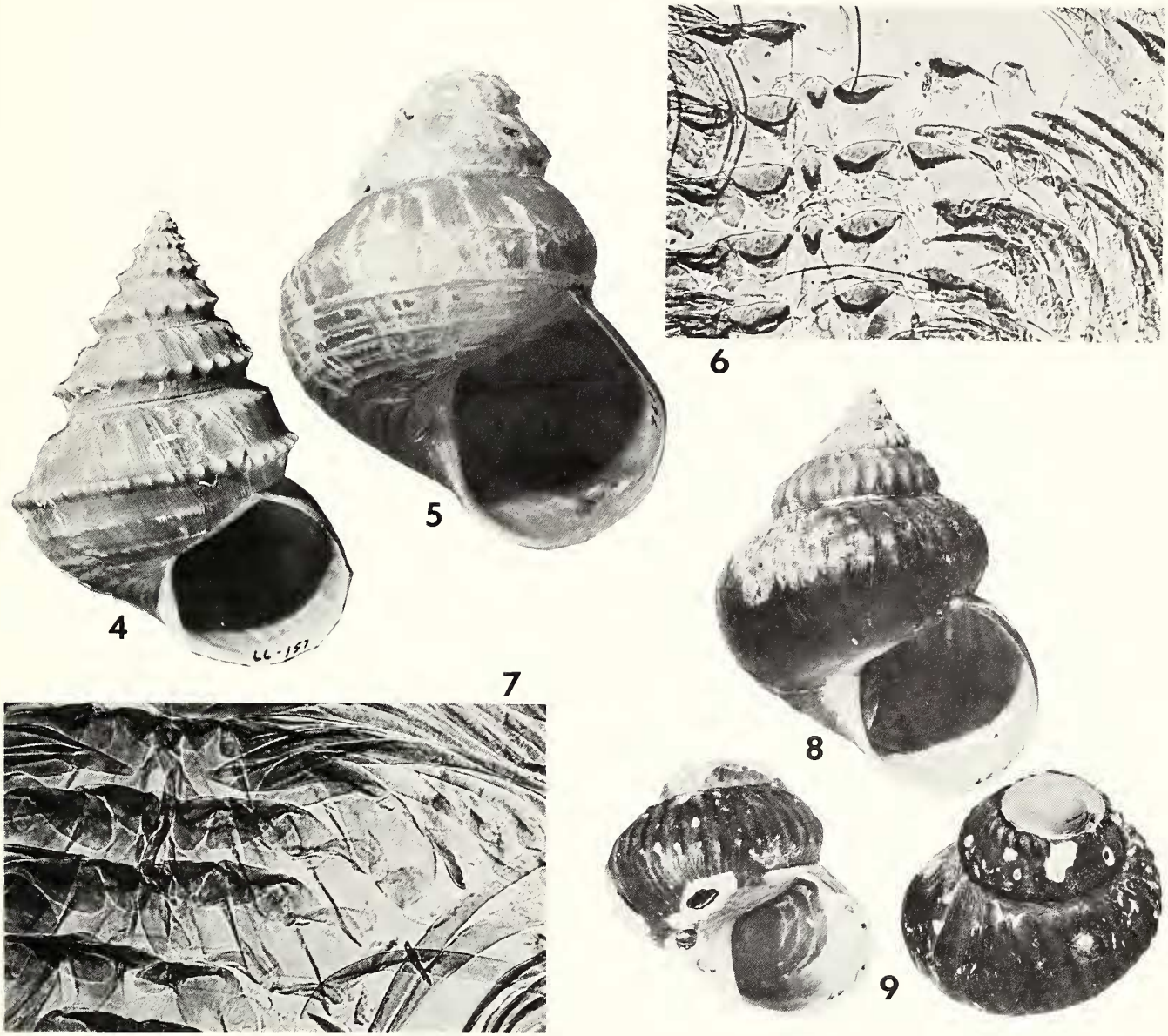
MATERIAL. Peru: W of Lobos de Tierra (LACM), S. of Lobos

4. McLean (1981) used the subfamily Amberleyinae for this group. That name was proposed at the family level by Wenz, 1938. The older Eucyclinae must be used, a name proposed at the family level by Koken, 1896.

de Tierra (LACM), S. of Lobos de Afuera (LACM). Chile: Junquillar (LACM), Los Vilos (LACM), Punta Salinas (LACM, fig. 4), Caleta Molles (LACM), Papudo, Zapallar, Quintero, Algarrobo, Punta Penablanca (LACM), Punta Topocalma (LACM). Specimens examined: more than 100.

TYPE MATERIAL AND TYPE LOCALITY. Holotype, USNM 96559 (Fig. 5). Type locality: 401 fm (733 m) off Manta, Ecuador.

DISTRIBUTION. Off Punta Mala, Panama (LACM 10369) (7°28′N) to Punta Topocalma, Chile (34°7′S). As is the case with *B. humboldti*, northern specimens occurring from Panama to Peru are known only from depths of 780–1,200 m, whereas



Figures 4 through 9, *Bathybembix macdonaldi* and *B. humboldti*.
Figures 4 through 6, *B. macdonaldi*. **Figure 4,** LACM 66-157, 960 m off Punta Salinas, Chile, height 69.3 mm. **Figure 5,** holotype, USNM 96559, 733 m off Manta, Ecuador, height 75 mm. **Figure 6,** radula ribbon, LACM 66-152, 750-730 m off Punta Topocalma, Chile, width of field 0.6 mm.
Figures 7 through 9, *B. humboldti*. **Figure 7,** radula ribbon, LACM 66-171, 605-735 m, W of Isla Macabi, Peru, width of field 0.7 mm. **Figure 8,** LACM 66-154, 1,170-1,480 m off Puerto San Antonio, Chile, height 61.7 mm. **Figure 9,** two views, LACM 66-171, 605-735 m W of Isla Macabi, Chile, height 39.7 mm.

those from Chile occur in similar depths and also as shallow as 200 m.

REMARKS. *Bathybembix macdonaldi* differs from *B. humboldti* in having strong peripheral nodes and a much lighter colored periostracum. Northern specimens tend to have a fainter subsutural cord and more numerous peripheral nodes, as in the holotype (Fig. 5).

Bathybembix humboldti Rehder, 1971

Figures 7–9

Bathybembix humboldti Rehder, 1971:578, fig. 4.

DESCRIPTION. Shell large, thin, suture deeply impressed, whorls rounded. Periostracum thin, brown, varying from yellowish brown to dark brown. Protoconch missing, teleoconch whorls seven on perfect specimens, but usually the early whorls are missing and sealed over with a chalky shell layer. Axial sculpture of low, narrow ribs on the upper half of the whorl, base nearly smooth except for broadly spaced, faintly marked spiral cords. Sculpture of three spiral cords on early whorls, forming elongate nodes where intersecting the axial ribs; one cord just below the suture and two others closer together at the periphery. Aperture nearly circular, outer lip thin, interior nacreous; operculum multispiral.

Dimensions: height 61.7 mm, diameter 46.9 mm (Fig. 8); height 39.7 mm, diameter 40.8 mm (Fig. 9); height 53.1 mm, diameter 44.3 mm (holotype).

Radula (Fig. 7): similar to that of *B. macdonaldi*.

MATERIAL. Peru: N of Isla Macabi (LACM), W of Isla Macabi (LACM, Fig. 9). Chile: Coquimbo (LACM), Los Vilos, Caleta Molles (LACM), Papudo, Zapallar, Algarrobo, Puerto San Antonio (LACM, Fig. 8), Topocalma, Pichilemu. Specimens examined: more than 100.

TYPE MATERIAL AND TYPE LOCALITY. Holotype, USNM 701665, 200 m, 17–18 km NW of Valparaíso, Chile.

DISTRIBUTION. Isla Macabi, Peru (7°44′S), to Pichilemu, Chile (34°27′S). Depth range: 200–1,480 m. In northern Peru, the depth range is 605–760 m; in Chile, the depth range is 200–1,480 m.

REMARKS. This species is characterized by its dark brown periostracum and the predominance of axial sculpture. Most specimens have the apical whorls badly eroded, although such specimens may seal the apical area with internally deposited shell layers (Fig. 9). Populations of *B. humboldti* have uniformly colored periostraca, some darker than others.

Subfamily Calliostomatinae

Genus *Calliostoma* Swainson, 1840

Type species (subsequent designation Hermannsen, 1846): *Trochus conulus* Linnaeus, 1758. Recent, Europe.

Subgenus *Otukaia* Ikebe, 1943

Type species (original designation): *Calliostoma kiheiziebisu* Otuka, 1939. Japan.

The calliostomatine trochids have a characteristic radula, modifications in the reproductive system, and a channel in the ventral lip—the pseudoproboscis—directed to the right (Fretter and Graham, 1962, fig. 92). Clench and Turner (1960) reviewed the Atlantic species, but a worldwide generic review has not been offered, and there are varying concepts of genera and subgenera in the family.

The two species of *Calliostoma* in the present material are members of the subgenus *Otukaia* Ikebe, 1943, a group of relatively large-shelled species broadly distributed in deep water throughout the world. They are characterized by a silky white surface layer, rather than a variegated color pattern, and sculpture of three spiral cords on the early whorls, which may or may not persist on later whorls. *Alertalex* Dell, 1956 (type species: *A. blacki* Dell, 1956, from New Zealand), is regarded as a synonym.

Calliostoma (Otukaia) chilena Rehder, 1971

Figures 10–12

Calliostoma chilena Rehder, 1971:590, figs. 2, 5.

DESCRIPTION. Shell large, thin, nonumbilicate; whorls flat to slightly convex, early spire profile slightly concave; color silky white with a gray-green nacreous sheen. Protoconch smooth, rounded, teleoconch whorls nine, early whorls with three spiral cords and axial ribs that produce square cancellations; these cords fade altogether by the fifth whorl. The suture is laid just below the basal keel; base with fine and even spiral cords, more prominent near the columella. Columella thick, slanted, outer lip sharp, thin. Operculum corneous, multispiral.

Dimensions: height 31.7 mm, diameter 26.5 mm (Fig. 10); height 32.7 mm, diameter 29.9 mm (Fig. 11); height 36.1 mm, diameter 31.9 mm (holotype).

Animal: cephalic lappets lacking, left and right neck lobes broad, rolled to form incurrent and excurrent siphons; epipodial tentacles four pairs, two in line with the neck lobes and two adjacent to the operculum; cephalic tentacles broad at the base, eye peduncles short, eyes large.

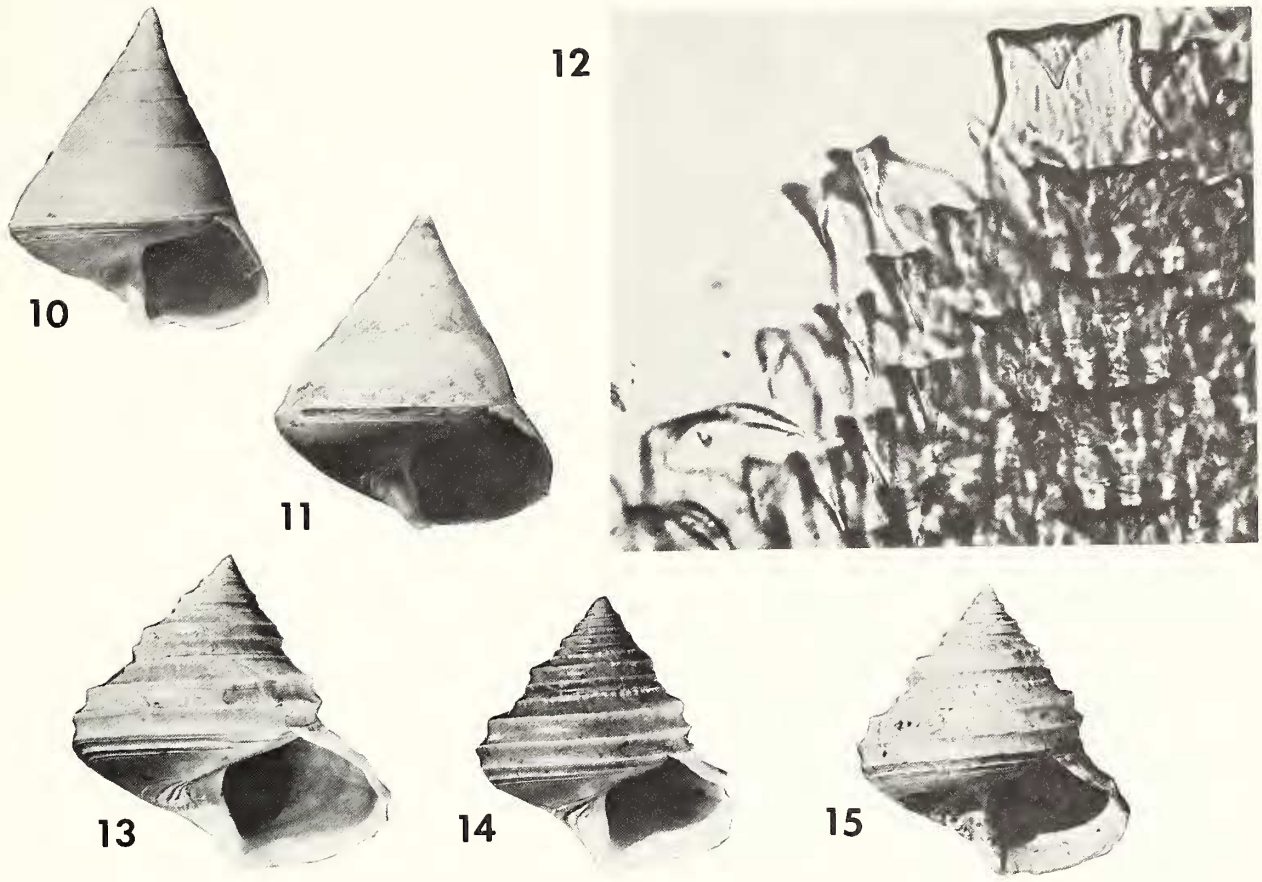
Radula (Fig. 12): the rachidian tooth is more than twice as broad as any of the lateral teeth; there are at least six pairs of lateral teeth, and the serrate, overhanging cusps of the lateral teeth are exceptionally long.

MATERIAL. Peru: W of Isla Macabi (LACM, Fig. 11). Chile: Coquimbo (LACM), Los Vilos, Punta Salinas (LACM, Fig. 10), Papudo, Zapallar, Punta Topocalma (LACM). Specimens examined: 12.

TYPE MATERIAL AND TYPE LOCALITY. Holotype, USNM 701669, 17 km NW of Valparaíso, Chile, 200 m.

DISTRIBUTION. Off Cebaco Island, Gulf of Panama (LACM 10370) (7°32′N), to Punta Topocalma, Chile (34°7′S). Depth range: 200–750 m. The minimum depth in Panama and northern Peru is 560 m; in Chile, the depths range from 200 to 750 m.

REMARKS. *Calliostoma chilena* was described originally from a single specimen. It is still known from rather few specimens. As Rehder noted, *C. chilena* most closely resembles *C. platinum* Dall, 1890, which ranges from British Columbia to southern California at depths of 150–700 m. *Calliostoma platinum* is broader and has convex rather than flat-sided whorls.



Figures 10 through 15, *Calliostoma chilena* and *C. delli* new species.
Figures 10 through 12, *C. chilena*.**Figure 10,** LACM 66-157, 960 m off Punta Salinas, Chile, height 31.7 mm. **Figure 11,** LACM 66-171, 605-735 m, W of Isla Macabi, Peru, height 32.7 mm. **Figure 12,** radular ribbon of specimen in Fig. 10, width of field 0.6 mm.
Figures 13 through 15, *Calliostoma delli* new species. **Figure 13,** holotype, LACM 1980, 400 m off Los Vilos, Chile, height 29.6 mm. **Figure 14,** paratype, LACM 198la, same locality, height 24.3 mm. **Figure 15,** paratype, LACM 1981b, same locality, height 29.0 mm.

Calliostoma (Otukaia) delli new species

Figures 13–15

DESCRIPTION. Shell large, thin, silky white, nonumbilicate, spire whorls convex. Protoconch of one and one-fourth whorls, teleoconch whorls seven, first teleoconch whorl with three spiral eords, noded to produce square cancellations; sculpture changing by the second whorl to three prominently projecting spiral cords, the uppermost cord beaded, the other two smooth. Mature sculpture of three prominent cords, subsutural cord the least prominent, remaining close to the suture and losing its beading by about the third whorl; second cord sharply defined and separated from the subsutural cord by a broad, smooth area; third cord equally strong and projecting to form the peripheral extent of the whorl. Basal keep sharp; suture laid directly on its lower surface, not forming a channel. Basal cording of about three fine cords on the outer edge and two to three bordering the columellar wall; intermediate area of base smooth except for fine spiral striae. Columellar wall thickened, slanted, forming a spur at the base; outer lip thin. Operculum corneous, multispiral. Animal and radula as in *C. chilena*.

Dimensions: height 29.6 mm, diameter 30.9 mm (holotype, Fig. 13): height 24.3 mm, diameter 23.2 mm (paratype, Fig. 14); height 29.0 mm, diameter 26.0 (paratype, Fig. 15).

MATERIAL. Chile: Los Vilos (LACM, type lot, Figs. 13–15), Papudo, Zapallar, Algarrobo, Punta Penablanca (LACM), Pichilemu, Constitución. Specimens examined: 114.

TYPE MATERIAL. Thirty-three specimens from the type locality, collected 29 May 1977, by Andrade, shrimp trawler GODEN WIND. Holotype, LACM 1980; paratypes, LACM 1981; paratypes, MNHN 200489; paratypes, MZICB 15.528; paratypes, USNM 784738.

TYPE LOCALITY. 400 m off Los Vilos, Chile (31°56′S; 71°54′W).

DISTRIBUTION. Los Vilos (31°56′S) to Constitución, Chile (35°20′S). Depth range 200–450 m.

DIAGNOSIS. A species of the subgenus *Otukaia* characterized by having three spiral cords prominent at all growth stages. It

differs from the similarly sculptured *C. blacki* (Dell, 1956) from New Zealand (see Dell, 1956:46, pl. 7, fig. 6) in being lower spired, and in having a weaker subsutural (first) cord and a stronger second cord.

REMARKS *Calliostoma delli* tends to be broader than high; one of the figured paratypes (Fig. 14) is unusually narrow, compared to most specimens in the type lot.

ETYMOLOGY. We are pleased to name this species in honor of Dr. Richard K. Dell of the National Museum of New Zealand, Wellington.

Superfamily Hipponicacea

Family Capulidae

Genus *Capulus* Montfort, 1810

Type species (original designation): *Patella ungaricus* Linnaeus, 1767. Recent, Europe.

Capulus species are sedentary, protandric, brooding limpets that are usually attached to shells of living bivalves. Most commonly, they are attached to pectinid bivalves, although the European type species may attach to stones or to *Turritella* (Thorson, 1965). Some of their nutrition is derived from filter feeding, as in the calyptraeids, but they also use the pseudoproboscis, an openly grooved proboscis, to take food from the host (Fretter and Graham, 1962). Recently, some species have been found to bore holes in the host shell, inserting the pseudoproboscis directly (Orr, 1962; Matsukuma, 1978).

The capulid in the present material from central Chile was attached to a large bivalve of the family Limidae, identified as *Acesta patagonica* (Dall, 1902). This is the second capulid species associated with a limid rather than a pectinid bivalve. Recently, Dell (1978) described *Capulus novaezelandiae*, attached to an unidentified species of *Acesta* from New Zealand waters. [For a review of *Acesta*, see Vokes, 1963].

Capulus ungaricoides (Orbigny, 1841)

Figures 16–19

Pileopsis ungaricoides Orbigny, 1841:457, pl. 78, fig. 4.
Capulus ungaricoides, Dall, 1909:234; Keen, 1966:3, pl. 1, figs. 14a, 14b; Keen, 1971:467, fig. 833.
"*Capulus chilensis* Dall," Carcelles, 1944:2, fig. 1.

DESCRIPTION. Shell large for the genus, thin but sturdy; outline nearly circular, irregular, conforming to the attachment surface. Apex narrow, strongly incurved, overhanging the posterior margin. Sculpture of fine radial ribs, rib interspaces consisting of narrow grooves. Periostracum and all traces of the radial ribs worn away on apical region but persisting near the margin; periostracum slightly overhanging the shell edge. Interior glossy white; muscle scar horseshoe-shaped.

Dimensions: diameter 39.6 mm, height 15.7 mm (Fig. 18); diameter 24.4 mm, height 9.0 mm (Fig. 16).

Animal: preserved specimens (Fig. 19) have the brood sac with a folded edge unlike that shown in other published illustrations of *Capulus* species. Animal not boring into the shell of its host but producing a notch in the shell edge (Fig. 18, left). The specimen in Figure 18 (right) is shown attached to the left valve of *A. patagonica*, and in Figure 18 (left), the attachment scar area is shown. The area corresponding to the posterior edge of the foot is eroded in the host shell; this is not a result of boring by the *Capulus*, because it is too far from the position of the head.

Radula (Fig. 17): rachidian and lateral strongly cusped and serrate on the edges, marginals uncusped.

MATERIAL. Chile: Coquimbo (LACM, Figs. 18, 19), Los Vilos (LACM, Fig. 16), Zapallar, Quintero. Specimens examined: six.

TYPE MATERIAL AND TYPE LOCALITY. Holotype, BM(NH) 54.12.4.554. Type locality: Paita, Peru.

DISTRIBUTION. Paita, Peru (5°5′S), to Isla de Los Estados, Argentina (54°47′S). Depth range off central Chile: 200–450 m.

REMARKS. Orbigny's species *Capulus ungaricoides*, described from Paita, Peru, has not been reported (other than in faunal lists) subsequent to its original description. The present material agrees with the original description and with illustrations of the holotype given by Keen (1966), except for lacking reddish rays, which may not be significant. Although the material treated here may not be positively identified with Orbigny's species, it is premature to distinguish separate species until material conforming to Orbigny's holotype can be shown to represent a separate species. Orbigny's holotype was probably not associated with an *Acesta* species, but because many species of *Capulus* are not host-specific, that need not preclude it being conspecific with the present material.

Capulus ungaricoides has the fine spiral sculpture present in *C. chilensis* Dall, 1908, and *C. novaezelandiae* Dell, 1978, but differs from both in having a narrower, more rapidly expanding apex. *Capulus chilensis* has regular early coiling of three distinct whorls, very unlike the narrow recurved apex of *C. ungaricoides*. Type material of *Capulus chilensis* has not previously been figured. The holotype measures 25 mm in diameter; a smaller paratype specimen is figured here (Fig. 20), to show the coiling of the early whorls.

Although Carcelles (1944) reported upon a specimen from Isla de los Estados (east of Tierra del Fuego), Argentina, identified as *C. chilensis*, his description agrees with the present material and forms the basis for the distributional record of *C. ungaricoides* cited above.

Superfamily Tonnacea

Family Cymatiidae

Genus *Fusitriton* Cossmann, 1903

Type species (monotypy): *Triton cancellatus* Lamarck, 1816 [= *Neptunea magellanica* Roeding, 1798]. Recent, Magellanic.

Fusitriton is noted for its bipolar distribution; species are common in shallow water in the North Pacific, South Pacific, and South Atlantic Oceans. At lower latitudes, all of the species become deeply submergent, which helps to explain the presence of the genus in cold waters of both the Northern and Southern Hemispheres.

The genus has been thoroughly reviewed by Smith (1970), who discussed the broadly distributed species in the present ma-

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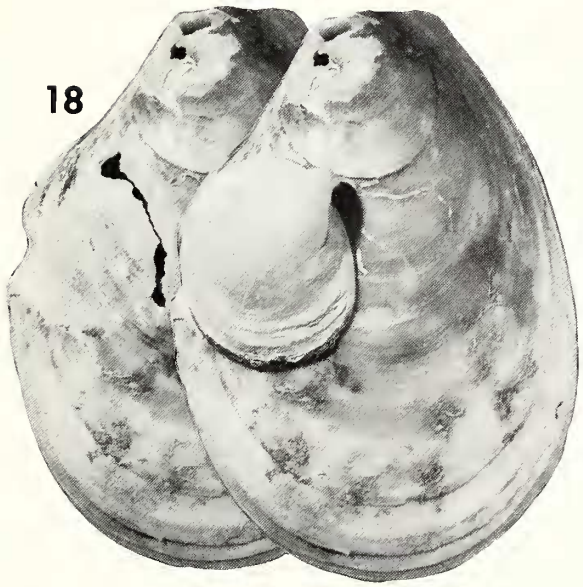

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Figures 16 through 20, *Capulus ungaricoides* and *C. chilensis*.
Figures 16 through 19, *C. ungaricoides*. **Figure 16,** preserved but retracted animal attached to shell, LACM 72487, 300-400 m off Los Vilos, Chile, diameter 24.4 mm. **Figure 17,** radular ribbon, LACM 72487, 300-400 m off Los Vilos, Chile, both pairs of marginal teeth on right side of ribbon folded to the right, width of field 0.9 mm. **Figure 18,** two views, LACM 72488, attached to left valve of *Acesta patagonica*, right view with *Capulus* in place, left view showing attachment sear and indentation in host shell corresponding to position of pseudoproboscis, 450 m off Coquimbo, Chile, length of *Acesta* 107.3 mm, diameter of *Capulus* 39.6 mm. **Figure 19,** body of specimen in Fig. 18, showing the folded edge of the brood sac.
Figure 20, *C. chilensis*, paratype, USNM 96926, "Albatross" station 2781, 636 m "off the Chilean coast," diameter 8.4 mm.

terial at length; her synonymy is not repeated here. Although two names for the Chilean species, *F. magellanicus* and *F. cancellatus,* have been used inconsistently by subsequent authors, Cernohorsky (1977) has recently shown that *F. magellanicus,* credited to Roeding, 1798, has priority over *F. cancellatus,* credited to Lamarck, 1816.

Fusitriton magellanicus (Roeding, 1798)

Figures 21–23

Neptunea magellanica Roeding, 1798:116.
Fusitriton magellanicus, Cernohorsky, 1977:107, fig. 3.
Triton cancellatus Lamarck, 1816:4.
Fusitriton cancellatus, Smith, 1970:475, pl. 42, figs. 4–10.

DESCRIPTION. Shell large, whorls six, rounded. Periostracum thick and bearing projecting hairs. Varices irregular, more frequent in juvenile stages, the mature lip marked by a final varix. Axial sculpture strongest on early whorls, nearly lacking on final whorl. Spiral cords low, with broad, shallow interspaces.

Dimensions: height 94.0 mm, diameter 47.3 mm (Fig. 21); height 85.1 mm, diameter 43.6 mm (Fig. 22).

Animal: Smith (1970, text fig. 2c) gave a sketch of the mantle cavity.

Radula (Fig. 23): typically taenioglossate, rachidian and lat-

eral finely denticulate. See also Smith (1970, text fig. 3d).

MATERIAL. Chile: Los Vilos (LACM), Punta Salinas (LACM), Caleta Molles (LACM, Fig. 21), Pupudo, Zapallar, Algarrobo, Punta Penablanca (LACM), Punta Topocalma (LACM). Specimens examined: 32.

TYPE MATERIAL AND TYPE LOCALITY. Type material unknown, type locality presumed to be the Strait of Magellan.

DISTRIBUTION. Los Vilos, Chile (31°56′S), to Tierra del Fuego; north in the Atlantic to Sarita, Rio Grande do Sul, Brazil (Smith, 1970). Depth range in central Chile: 180–960 m.

REMARKS. *Fusitriton magellanicus* is the only member of the present assemblage of large gastropods also to occur in relatively shallow water in southern Chile. McLean has collected specimens at several localities in the Gulf of Corcovado east of Chiloe Island by diving in depths as shallow as 5 m (Fig. 22).

Superfamily Muricacea

Family Muricidae

Subfamily Trophoninae

Genus *Trophon* Montfort, 1810

Type species (original designation): *Murex magellanicus* Gmelin, 1791 (= *Buccinum geversianum* Pallas, 1774). Recent, Magellanic.

The muricid subfamily Trophoninae, of which *Trophon* is the type genus, comprises white-shelled forms with axial lamellae rather than varices, open canals, and simple apertures. It is the least known group in the Muricidae; only the type species of recognized genera were treated by Radwin and D'Attilio (1976).

Trophon is primarily an austral genus with numerous species in the Antarctic and subantarctic region. The type species, which is relatively large, has both axial and spiral sculpture and is common in the intertidal zone in the Fuegian and Patagonian regions. An illustration given by Radwin and D'Attilio (1976, fig. 130), though identified as *Stramonitrophon laciniatus,* is actually *T. geversianus.*

Trophon bahamondei new species

Figures 24–25

DESCRIPTION. Shell moderately large, thin but sturdy, white, spire high, canal long, recurved, open; length of aperture and canal slightly greater than height of spire, aperture shape quadrate, canal constricted. Protoconch eroded, teleoconch whorls six, early whorls bulging at midwhorl, having about 12 thick axial ribs. Mature sculpture of 10 to 13 axial lamellae, suppressed on the shoulder, at the periphery producing open, raised spines that rise above the level of the suture; lamellae sharply raised on the body whorl but suppressed on the siphonal canal; siphonal fasciole with overlapping lamellae; axial sculpture lacking. Aperture simple, lacking denticles or columellar callus.

Dimensions: height 49.4 mm, diameter 26.1 mm (holotype, Fig. 25).

Radula (Fig. 24): typical for the genus, rachidian plate broad and shallow, having five cusps, a strong central cusp and two on either side, the outermost the larger; lateral teeth sickle-shaped.

MATERIAL. Chile: Coquimbo (LACM), Los Vilos (LACM), Papudo, Zapallar, Quintero, Algarrobo, Pichilemu (LACM, holotype, Fig. 25). Specimens examined: 73.

TYPE MATERIAL. Twenty-four specimens from the type locality, collected 25 May 1976, by Andrade, unidentified shrimp trawler. Holotype, LACM 1982; paratypes, LACM 1983, paratypes, MNHN 200490; paratypes, MZICB 15.529; paratypes, USNM 784739.

TYPE LOCALITY. 340 m off Pichilemu, Chile (34°27′S).

DISTRIBUTION. Coquimbo (29°58′S) to Pichilemu (34°27′S), Chile. Depth range: 200–450 m.

DIAGNOSIS. A species of *Trophon* characterized by its quadrate aperture, and sculpture of axial lamellae, which are spinose at the periphery. It most resembles *Trophon* (*Stramonitrophon*) *plicatus* (Solander *in* Lightfoot, 1786),[5] a common shallow-water species from southern Chile in which spiral seulpture is lacking, but is smaller with the aperture more quadrate and the canal more constricted. The two species are not closely related, for *Trophon plicatus* has a unique radula in which there are accessory cusps (the feature upon which the subgenus *Stramonitrophon* is based).

REMARKS. There is virtually no variation in *Trophon bahamondei;* all specimens examined are very similar.

ETYMOLOGY. We are pleased to dedicate this species to Dr. Nibaldo Bahamonde N., of the Museo Nacional de Historia Natural, Santiago.

Family Columbariidae

Genus *Columbarium* Martens, 1881

Type species (original designation): *Pleurotoma* (*Columbarium*) *spinicincta* Martens, 1881. Recent, Queensland, Australia.

Columbarium is one of several genera in the Columbariidae, a family restricted to moderately deep water. Shell form and structure of the protoconch resembles that of *Fusinus* Rafinesque, 1815, in the Fasciolariidae, but the radula relates the genus to the Muricacea. Living and fossil Columbariidae of the world were reviewed by Darragh (1969). Japanese species were recently reviewed by Habe (1979).

Although the family is represented in the western Atlantic (Clench, 1944; Bayer, 1971), no species until now has been reported from the eastern Pacific.

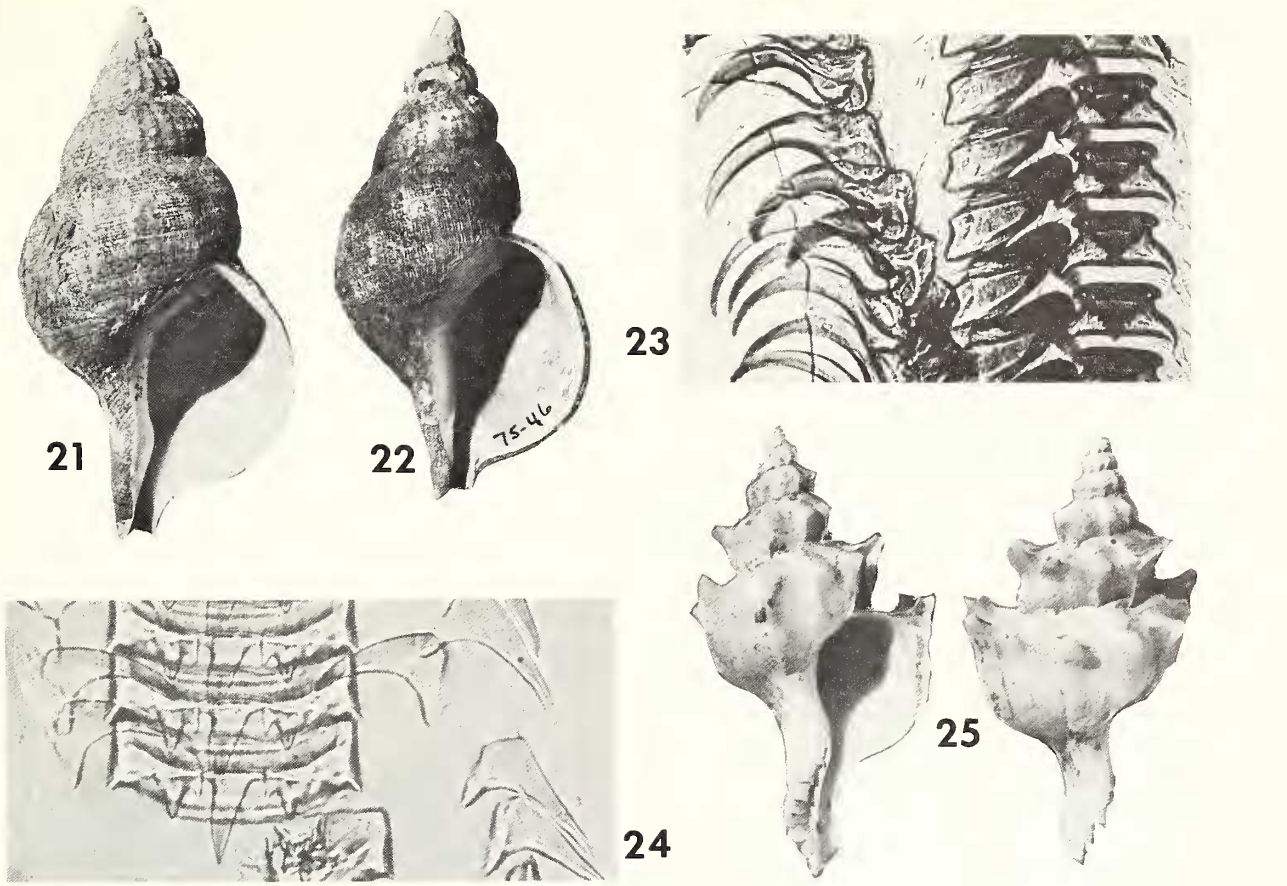
Authors are not agreed as to whether the available taxa should be genera or subgenera, but the new species that follows is clearly a member of *Columbarium, sensu stricto,* a genus well represented in the Tertiary and Recent of New Zealand, Australia, and Japan.

Columbarium tomicici new species

Figures 26–30

DESCRIPTION. Shell fusiform, length of aperture and canal about two-thirds the total length, white under a thin brown periostracum. Protoconch eroded, teleoeonch whorls six, early

5. *Trophon plicatus* is better known as *T. laciniatus* (Gmelin, 1791) as used by Dell (1971). However, Cernohorsky (1977) showed that *T. plicatus*, credited to Solander *in* Lightfoot, 1786, is the prior name.



Figures 21 through 25, *Fusitriton magellanicus* and *Trophon bahamondei* new species.
Figures 21 through 23, *Fusitriton magellanicus*. **Figure 21,** LACM 66-156, 580 m off Caleta Molles, Chile, height 94.0 m. **Figure 22,** LACM 75-46, 5 m, Isla Laitec, Chiloe Province, Chile, height 85.1 mm. **Figure 23,** radula ribbon, LACM 66-156, 580 m off Caleta Molles, Chile, width of field 1.2 mm. **Figures 24 and 25,** *Trophon bahamondei* new species. **Figure 24,** radular ribbon, LACM 72491, 240-400 m off Los Vilos, Chile, width of field 0.35 mm. **Figure 25,** holotype, LACM 1982, 340 m off Pichilemu, Chile, height 49.4 mm.

whorls with a sharp median carina, at first with weak projections, but changing to thin, triangular, posteriorly directed spines, 9 to 16 on the final whorl. Shoulder and spire whorls smooth or finely striate; suture laid upon, or just anterior to, a stout cord (the anterior carina of Darragh, 1969). Base and canal with prominent, rounded, nonscabrous spiral cords, with interspaces of nearly equal or lesser width, about five across the base and ten more on the canal. Columellar callus thin, not raised to form a columellar lip; aperture subquadrate, lip thin.

Dimensions: height 46.8 mm, diameter 22.8 mm (holotype, Fig. 26); height 78.4 mm, diameter 33.2 mm (Fig. 29).

Radula (Fig. 30): rachidian plate with curved base and three cusps that project over the basal plate of the next row, the middle cusp the longest; lateral tooth with large base and curved tip. The radula is similar to that of other species in the family (see Bayer, 1971:172).

MATERIAL. Peru: S of Lobos de Afuera (LACM, Fig. 29), N of Isla Macabi (LACM). Chile: Junquillar (LACM, holotype, Fig. 26), Coquimbo (LACM, Fig. 27), Los Vilos (LACM), Punta Salinas (LACM), Papudo, Algarrobo. Four other specimens are in the LACM collection from depths of 520–1,200 m in northern Peru (Banco de Mancora, Fig. 28; Chilca, Fig. 30; Mollendo), received from Dr. Enrique del Solar of Lima, Peru. Specimens examined: 30.

TYPE MATERIAL. Thirteen specimens from the type locality, collected by R/V ANTON BRUUN, station 714, 16 August 1966. Holotype, LACM 1984; paratypes, LACM 1985; paratype, MNHN 200491; paratypes, MZICB 15.530; paratypes, USNM 784740. Although there are single larger specimens from other localities in the material at hand, this lot was selected as the type lot because it contains 13 specimens (only 2 live-collected) of about the same size as the holotype, enabling distribution of paratypes from the type locality.

TYPE LOCALITY. 950 m, W of Junquillar, Chile (25°0′S, 70°40′W).

DISTRIBUTION. Banco de Mancora, Peru (3°25′S), to Algarrobo, Chile (33°22′S). Depth range: 240–1,200 m.

DIAGNOSIS. A species of *Columbarium* characterized by its sculpture of triangular spines at the periphery and regular, nonscabrous cords on the base and canal. *C. tomicici* most resembles *C. veridicum* Dell, 1963, from New Zealand (see Powell, 1979:169, pl. 37, fig. 1), which entirely lacks spiral sculpture on the base and canal. General proportions are similar to those of the Japanese *C. pagoda* (Lesson, 1840), which has a projecting

columellar lip and may have spinose sculpture on the canal, as figured by Habe (1979).

REMARKS. *Columbarium tomicici* has the essential features of *Columbarium, sensu stricto,* as diagnosed by Darragh (1969), except that the parietal or inner lip callus is not raised, the spiral cords of the base and canal are nonscabrous, and there is no tooth on the outer lip at the position of the anterior (basal) carination.

ETYMOLOGY. This species is dedicated to Prof. Jorge Tomicic K., of the Universidad de Antofagasta, Antofagasta, Chile.

Superfamily Buccinacea

Family Buccinidae

Subfamily Buccinulinae

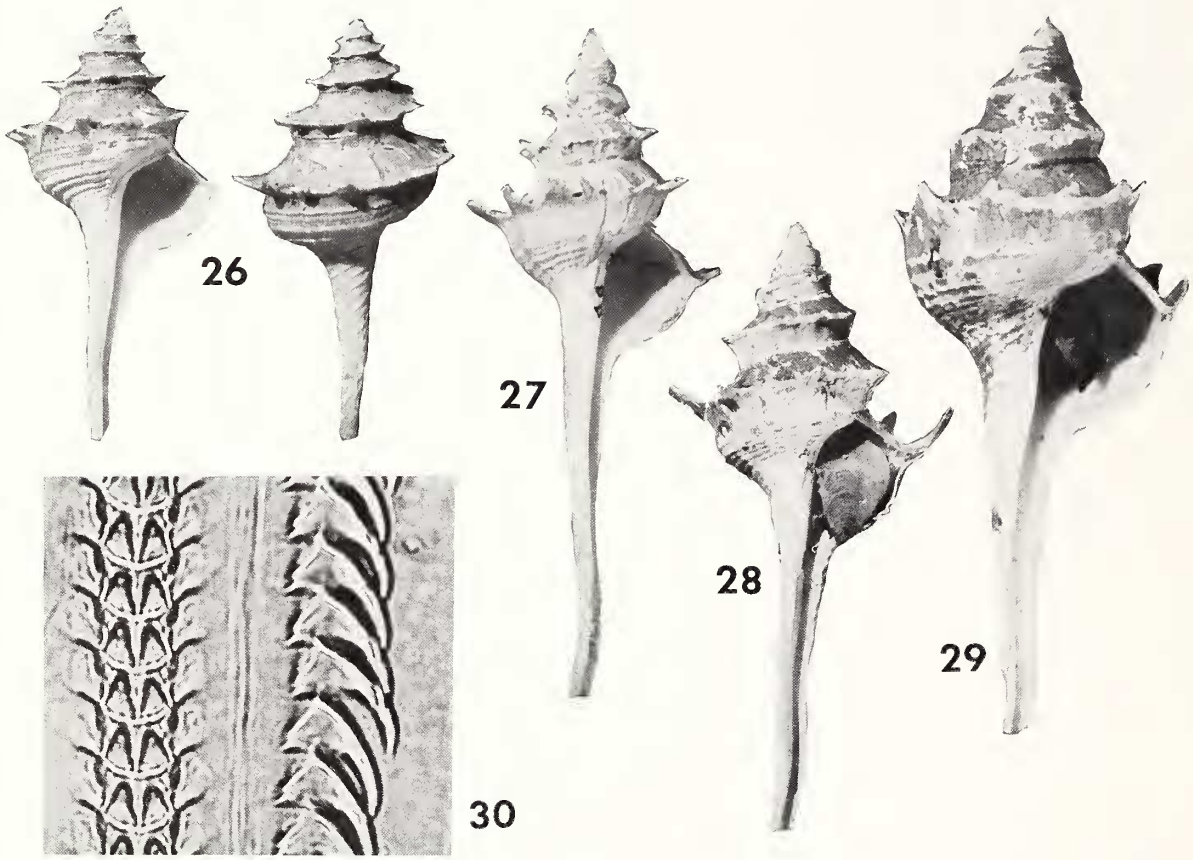
Powell (1929, 1951, 1979) has discussed the higher classification of buccinid whelks with particular reference to southern genera. In early publications, he advocated the use of several families based on radular characters, but, more recently (Powell, 1979), he placed genera with a tricuspid rachidian and a tricuspid lateral in the subfamily Buccinulinae, of which *Aeneator* is a member.

Genus *Aeneator* Finlay, 1927

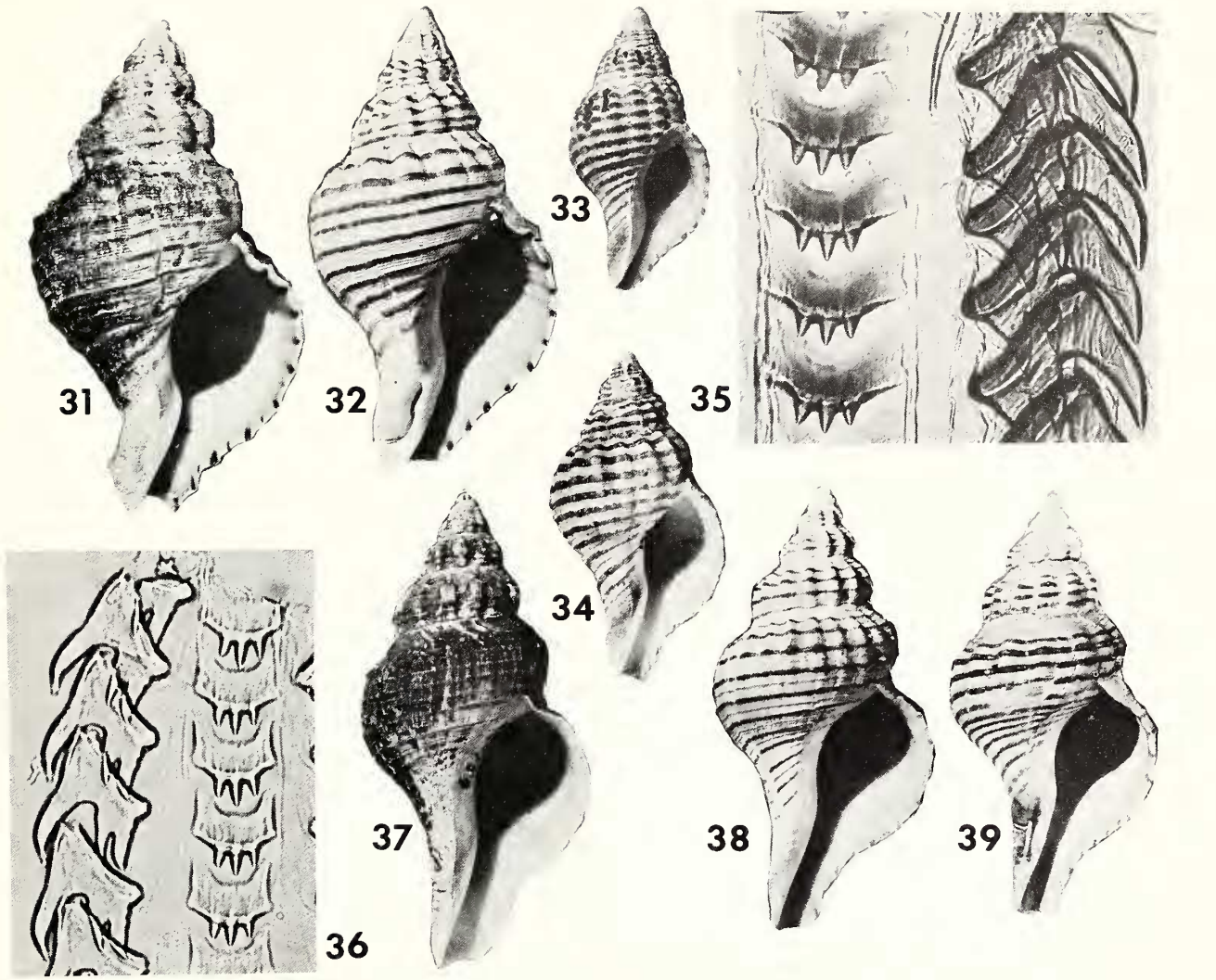
Type species (original designation): *Verconella marshalli* Murdoch, 1924. Pleistocene, New Zealand.

Rehder (1971) introduced the New Zealand genus *Aeneator* to the Chilean fauna with his description of *Aeneator* (*Ellicea*) *loisae,* although he did not mention the most common Chilean species of the group, *A. fontainei* (Orbigny, 1841). The latter species was assigned by Dall (1909) and Keen (1966) to *Austrofusus* Kobelt, 1879. *Austrofuscus,* however, pertains to a New Zealand group with broad apertures and short, twisted canals.

New Zealand species of *Aeneator* have been discussed by Dell, (1956, 1963), Beu (1979), and Powell (1979). The occurrence of the genus in Chile has not been mentioned by these authors. The Chilean species seem to differ in having a thickened or expanded final lip. However, the living representative of the Pleistocene type species, *Aeneator marshalli separabilis* Dell, 1956, from



Figures 26 through 30, *Columbarium tomicici* new species. **Figure 26,** 2 views of holotype, LACM 1984, 950 m off Junquillar, Chile, height 46.8 mm. **Figure 27,** LACM 75-88, depth unknown off Coquimbo, Chile, height 73.7 mm. **Figure 28,** LACM 71-234, 520 m, Banco de Mancora, Peru, height 65.6 mm. **Figure 29,** LACM 74-9, 1,200 m S of Isla Lobos de Afuera, Peru, height 78.4 mm. **Figure 30,** radular ribbon, LACM 72-187, 800 m S of Chilca, Peru, width of field 0.2 mm.



Figures 31 through 39, *Aeneator fontainei*. **Figure 31,**LACM 75-21, 20 m off Mejillones, Chile, height 70.0 mm. **Figure 32,**LACM 75-21, same locality, height 66.3 mm. **Figure 33,**LACM 54737, 40 m off Montemar, Chile, height 39.5 mm. **Figure 34,**LACM 66-161, 56-95 m off Punta Mar Brava, Chile, height 46.6 mm. **Figure 35,** radular ribbon, LACM 75-21, 20 m off Mejillones, Chile, width of field 0.5 mm. **Figure 36,** radular ribbon, LACM 66-150, 260-280 m off Punta Penablanca, Chile, width of field 0.35 mm. **Figure 37,** LACM 66-159, 110 m off Punta Hornos, Chile, height 67.0 mm. **Figure 38,** LACM 66-159, same locality, height 64.9 mm. **Figure 39,** LACM 72493, 270 m off Punta Toro, Chile, height 58.9 mm.

New Zealand, has an expanded outer lip. The allocation of the Chilean species to *Aeneator* is therefore followed here.

Ellicea Finlay, 1927 (type species: *Siphonalia orbita* Hutton, 1855), used by Dell (1956) and Rehder (1971) as a subgenus to distinguish species with strong spiral sculpture, was reduced to synonymy by Powell (1979), who found no clear separation of species on that character.

The following diagnosis of *Aeneator* is offered: fusiform buccinids of moderate size, canal plus aperture more than half the length of the shell, whorls rounded but for a subsutural concavity; lip with a broad shallow sinus below the suture; sculpture of strong axial ribs overridden by spiral cords, rachidian and laterals tricuspid.

Aeneator fontainei (Orbigny, 1841)

Figures 31–39

Fusus fontainei Orbigny, 1841:447, pl. 63, fig. 2.
Austrofusus fontainei, Dall, 1909:213; Keen, 1966:4.
Fusus alternatus Philippi, 1847, pl. 4, fig. 6; Reeve, 1847, pl. 2, fig. 6.
Siphonalia alternata, Tryon, 1881:137.

DESCRIPTION. Shell large, covered by periostracum, length of aperture and canal more than half the length of the shell. Whorls six, convex except for a concave subsutural area, suture not deeply impressed. Axial sculpture on penultimate whorl of 15–17 rounded ribs, interspaces slightly narrower; axial sculp-

ture usually lacking altogether on the final half whorl. Spiral sculpture of major and minor cords; major cords four on early whorls, raised, dark brown, the interspaces twice as broad as these cords, cords overriding the axial ribs. Minor cords between each brown cord about five, separated by incised grooves. Lip lirate within, edge sharp, thick behind the edge, edge marked with brown at the termination of the cords.

Dimensions: height 70.0 mm, diameter 38.0 mm (Fig. 31); height 67.0 mm, diameter 32.0 mm (Fig. 37).

Radula (Figs. 35, 36): typical for the genus, rachidian and laterals tricuspid.

MATERIAL. Chile: Punta Mar Brava (LACM, Fig. 34), Punta Hornos (LACM, Figs. 37, 38), Coquimbo (LACM), Los Vilos (LACM), Papudo (LACM), Quintero (LACM), Punta Penablanca (LACM), Punta Panulcillo (LACM), Punta Toro (LACM, Fig. 39). Other records: Bahia Independencia and Bahia San Juan, Peru, 20–50 m, collected by the Hancock Expeditions in 1938; Mejillones, Chile (LACM, Figs. 31, 32), collected by McLean in 1975 in 20 m by scuba diving. Specimens examined: more than 100.

TYPE MATERIAL AND TYPE LOCALITY. Five specimens, BM(NH) 54.2.4.517 (Keen, 1966). Type locality: Callao, Peru. Type locality for *F. alternatus:* Mejillones, Chile.

DISTRIBUTION. Independencia Bay, Peru (LACM) (14°13′S), to Punta Toro, Chile (33°1′S). Depth range: 20–350 m.

REMARKS. *Aeneator fontainei* is the only offshore species treated here to occur also in relatively shallow water (at depths of 20 m or more) in central Chile. Three extremes in shell form are noted. Most specimens from shallow water (Figs. 31, 32) have relatively thick shells with pronounced development of siphonal fasciole; the darkly marked cords are prominent. Specimens from archibenthal depths (Figs. 37–39) have a thinner shell and a straighter canal, and the dark cords are less prominent than those of the shallow-water form. A fine, dark intercalary cord may appear in the interspace between major cords, as in Figure 38. At first glance, especially with periostracum intact as in Figure 37, these specimens appear very different from the shallow-water form. However, specimens such as that in Figure 39 seem to be intermediate between the shallow- and deep-water forms. Finally, there is a dwarf form occurring at intermediate depths (Fig. 33), in which there is little subsutural concavity, a more crowded condition of the axials, and more numerous, more closely spaced dark cords. This form shows complete intergradation (Fig. 34) with the usual shallow-water form.

Aeneator loisae Rehder, 1971

Figures 40–44

Aeneator (*Ellicae*) *loisae* Rehder, 1971:593, figs. 7, 8.

DESCRIPTION. Shell large for the genus, fusiform, surface chalky white, covered by periostracum, length of aperture and canal more than half the length of the shell. Whorls seven, convex, except for a concave subsutural area; suture not deeply impressed. Axial sculpture on early whorls of about 14 low ribs running from suture to suture, interspaces narrower than the ribs; ribs lacking altogether on body whorl, somewhat indistinct on penultimate whorl but prominent on earlier whorls. Spiral sculpture of major cords alternating with secondary cords, finer tertiary cords may appear in the interspaces and may be superimposed on the major cords. Major cords about nine to ten on the penultimate whorl, continuing with regular spacing across the body whorl and canal. Lip sinuate on upper part, weakly lirate within, scalloped to correspond with the spiral cords; final lip flared. Canal long, parietal and columellar area well defined, glazed.

Dimensions: height 91.8 mm, diameter 43.7 mm (Fig.40); height 88.5 mm, diameter 37.9 mm (Fig. 43); height 74.7 mm, diameter 37.3 mm (holotype, Fig. 42).

Radula (Fig. 44): central and lateral teeth tricuspid; see also Rehder, 1971, fig. 8.

MATERIAL. Chile: Coquimbo (LACM), Los Vilos (LACM), Caleta Molles (LACM, Fig. 43), Papudo, Zapallar, Quintero (LACM), Algarrobo, Cabo Carranza (LACM, Figs. 40–41). Specimens examined: more than 100.

TYPE MATERIAL AND TYPE LOCALITY. Holotype, USNM 701667. Type locality: 200 m, 17–18 km NW of Valparaíso, Chile.

DISTRIBUTION. Coquimbo (29°58′S), to Cabo Carranza, Chile (35°27′S). Depth range: 200–450 m.

REMARKS. *Aeneator loisae* differs from both *A. fontainei* and *A. castillai* new species in lacking any brown coloration to the shell. It also has more numerous primary cords than does *A. fontainei*. Its closest relative, as noted by Rehder (1971), is the New Zealand species *A. benthicola* Dell, 1973 (see Powell, 1979:202, pl. 41, fig. 3).

Aeneator loisae is highly variable in proportions. The holotype (Fig. 42) is relatively broad; specimens from Cabo Carranza (Figs. 40, 41) are more slender, and a single specimen from Caleta Molles (Fig. 43) is still more slender.

Aeneator castillai new species

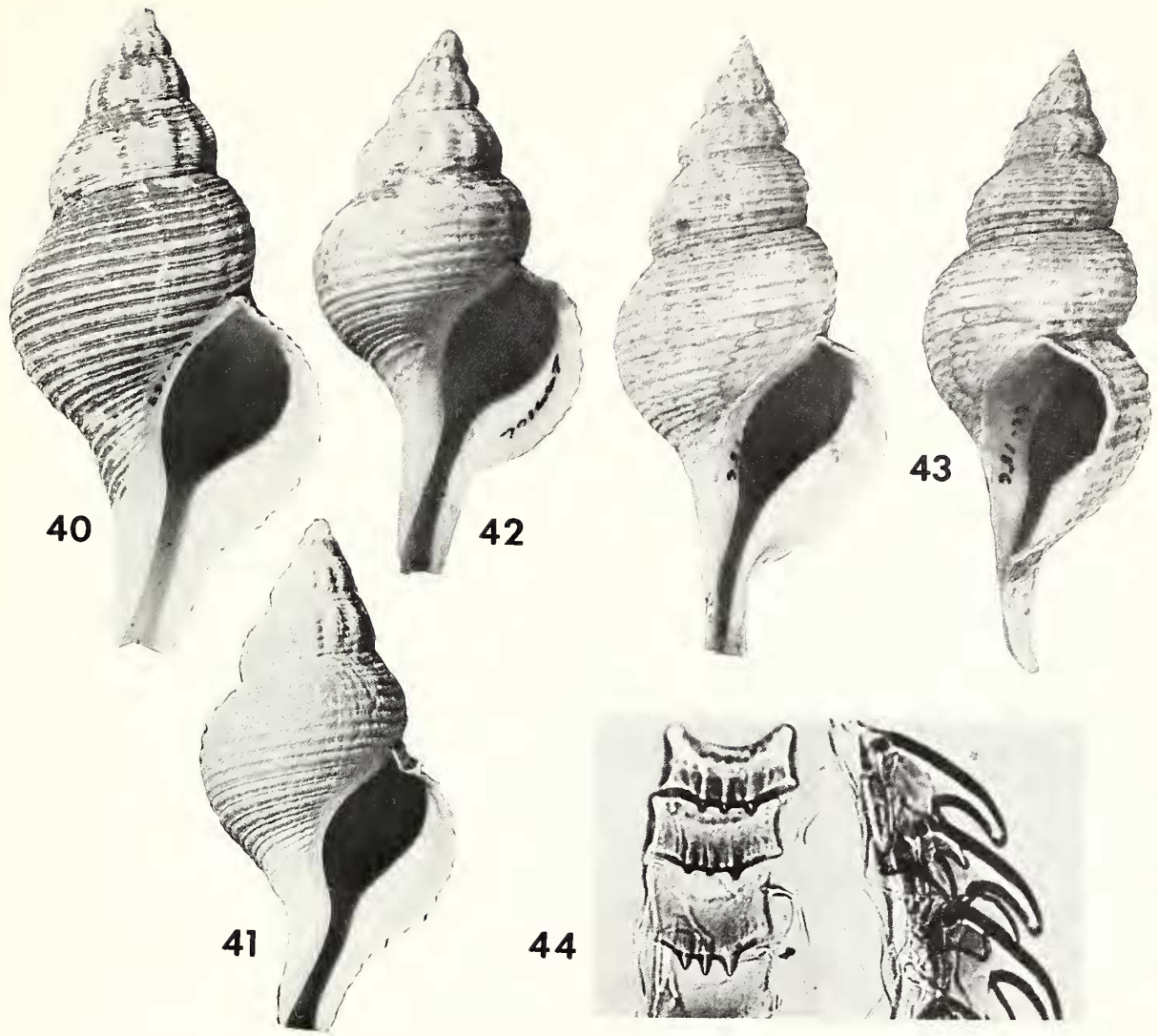
Figures 45–50

DESCRIPTION. Shell large, fusiform, length of aperture and canal more than half the length of the shell; canal relatively short, twisted. Shell light brown under a thin periostracum, often with a lighter colored band coinciding with the periphery. Whorls six, protoconch and early whorls eroded; whorls convex but for a concave subsutural area; suture not deeply impressed. Axial sculpture on penultimate whorl of about 16 low ribs, strong across the periphery but faint in the subsutural area; final whorl with weak sculpture; axial sculpture lacking altogether on the final half whorl. Spiral sculpture of fine cords alternating in strength, all cords in the concave subsutural area fine; those of the periphery and base coarser, frequently darker in color. Lip faintly lirate within, sinuate on upper part, final lip not expanded. Parietal and columellar area well defined, glazed.

Dimensions: height 78.7 mm, diameter 39.8 mm (holotype, Fig. 45); height 75.7 mm, diameter 37.8 mm (Fig. 47).

Radula (Fig. 50): typical for the genus, central and lateral teeth tricuspid.

MATERIAL. Chile: Coquimbo (LACM, Fig. 49), Los Vilos (LACM, Figs. 46–48), Papudo (LACM, type lot, Fig. 45), Zapallar (LACM), Quintero (LACM), Punta Penablanca (LACM). Specimens examined: 23.



Figures 40 through 44, *Aeneator loisae.* **Figure 40,** LACM 66-153, 290-450 m off Cabo Carranza, Chile, height 91.8 mm. **Figure 41,** LACM 66-153, same locality, height 70.0 mm. **Figure 42,** holotype, USNM 701667, 200 m off Valparaiso, Chile, height 74.7 mm. **Figure 43,** two views, LACM 66-156, 580 m off Caleta Molles, Chile, height 88.5 mm. **Figure 44,** radular ribbon, LACM 66-153, 290-450 m off Cabo Carranza, Chile, width of field 0.5 mm.

TYPE MATERIAL. Nine specimens from the type locality, collected 29 March 1977, by Andrade, shrimp trawler GODEN WIND. Holotype, LACM 1986; paratypes, LACM 1987; paratypes, MNHN 200492; paratypes, MZICB 15.532; paratypes, USNM 784741.

TYPE LOCALITY. 300 m off Papudo, Chile (32°31′S; 71°54′N).

DISTRIBUTION. Coquimbo (29°55′S), to Punta Penablanca, Chile (33°22′S). Depth range: 200–450 m.

DIAGNOSIS. A species of *Aeneator* characterized by its rather short, twisted canal and the absence of axial ribs in the concave subsutural area. It differs from both *A. fontainei* and *A. loisae* in these features. Additionally it differs from the offshore form of *A. fontainei* in having more numerous spiral cords and a flesh colored surface. From *A. loisae,* it also differs in having a brown rather than white shell coloration.

REMARKS. The surface layers of the shell of *A. castillai* are particularly prone to erosion, leaving an unsculptured, chalky shell surface upon loss of the sculptured layer. A number of the specimens are partially or completely eroded (Fig. 49).

ETYMOLOGY. We are pleased to name this species after Dr. Juan Carlos Castilla, of the Universidad Catolica, Santiago.

Superfamily Volutacea

Family Volutidae

Subfamily Odontocymbiolinae

Genus *Miomelon* Dall, 1907

Type species (original designation): *Volutilithes philippiana* Dall, 1890. Recent, central Chile.

Miomelon is known from three species occurring in the region from central Chile to the vicinity of the Falkland Islands. The species in the present collection was identified by Weaver and Dupont (1970) and Rehder (1971) as *M. philippiana* (Dall, 1890). Stuardo and Villarroel (1974) showed that Dall's species, which is known only from the single holotype from abyssal depths off central Chile (1,238 m, 38°8′S), differs from the more common archibenthal species, which they described as *M. alarconi*.

Stuardo and Villarroel treated the radula and anatomy of *Miomelon alarconi,* confirming that the genus should be assigned to the volutid subfamily Odontocymbiolinae.

Miomelon alarconi Stuardo and Villarroel, 1974

Figures 51, 52

Miomelon philippiana (Dall, 1890), of Weaver and DuPont, 1970:132, pl. 56, figs. C, D; Rehder, 1971:594. Not Dall, 1890.
Miomelon alarconi Stuardo and Villarroel, 1974:140, figs. 4a, 4b, 5a, 5b.

DESCRIPTION. Shell moderately large, aperture length equal to spire height; shoulder concave, siphonal canal broad, outer lip thin. Sculpture of fine axial ribs and less prominent spiral cords, interspaces broad. Columella with three or four plaits, the anteriormost the strongest. Color light brown under a thin brown periostracum; parietal glaze light brown; surface often chalky in specimens that have lost the periostracum.

Dimensions: height 74.9 mm, diameter 32.0 mm (Fig. 52); height 89.7 mm, diameter 39.4 mm (holotype).

Radula (Fig. 51): base of rachidian elongate, strongly tricuspidate. See also Stuardo and Villarroel (1974, fig. 2).

MATERIAL. Chile: Coquimbo (LACM), Los Vilos (LACM), Papudo, Zapallar, Algarrobo, Pichilemu (LACM), Cabo Carranza (LACM, Fig. 52). Specimens examined: more than 100.

TYPE MATERIAL AND TYPE LOCALITY. Holotype, MZICB 5553; paratypes, MZICB 5554, 5555, 5556. Type locality: 125 m, Chanco Bay, Chile (35°45′S).

DISTRIBUTION. Coquimbo (29°58′S), to 37°51′S (Stuardo and Villarroel, 1974), Chile. Depth range: 125–450 m.

REMARKS. *Miomelon alarconi* is larger, heavier, and more broadly inflated and has coarser spiral sculpture than *M. philippiana*.

Superfamily Cancellariacea

Family Cancellariidae

The large new species of *Cancellaria* in the present material was unexpected, for the previously known austral representatives of the family include such genera as *Admete* Kroyer, 1842, and related small-shelled genera (see Carcelles and Williamson, 1951; Powell, 1960, 1979).

The cancellariid radula is unlike that of stenoglossate neogastropods (Olsson, 1970; Keen, 1971), yet other features of cancellariid anatomy are typical of those of higher neogastropods (Graham, 1966; Harasewych and Petit, 1982).

Genus *Cancellaria* Lamarck, 1799

Type species (monotypy): *Voluta reticulata* Linnaeus, 1767. Recent, Florida.

Subgenus *Crawfordina* Dall, 1919 [= *Crawfordia* Dall, 1918, not Pierce, 1908]

Type species (original designation): *Cancellaria crawfordiana* Dall, 1891. Recent, California.

The subgenus *Cancellaria, sensu stricto,* comprises moderately large shelled forms with reticulate sculpture and prominent columellar plaits. *Cancellaria stuardoi* new species is most closely related to the type species of the subgenus *Crawfordina*. Grant and Gale (1931:614) diagnosed *Crawfordina* as follows: "This section differs from *Cancellaria, s. s.,* in the more elongate shape, lighter weight, smaller, more oblique plaits, and shorter columella." Another feature to be mentioned is the minimal development of the parietal callus.

There are three members of the subgenus *Crawfordina:* the offshore Californian type species, the new Chilean species described here, and the connecting link, the deep-water Panamic species, *Cancellaria io* Dall, 1896 (see Keen, 1971:654, fig. 1477), from 589 m, Panama Bay.

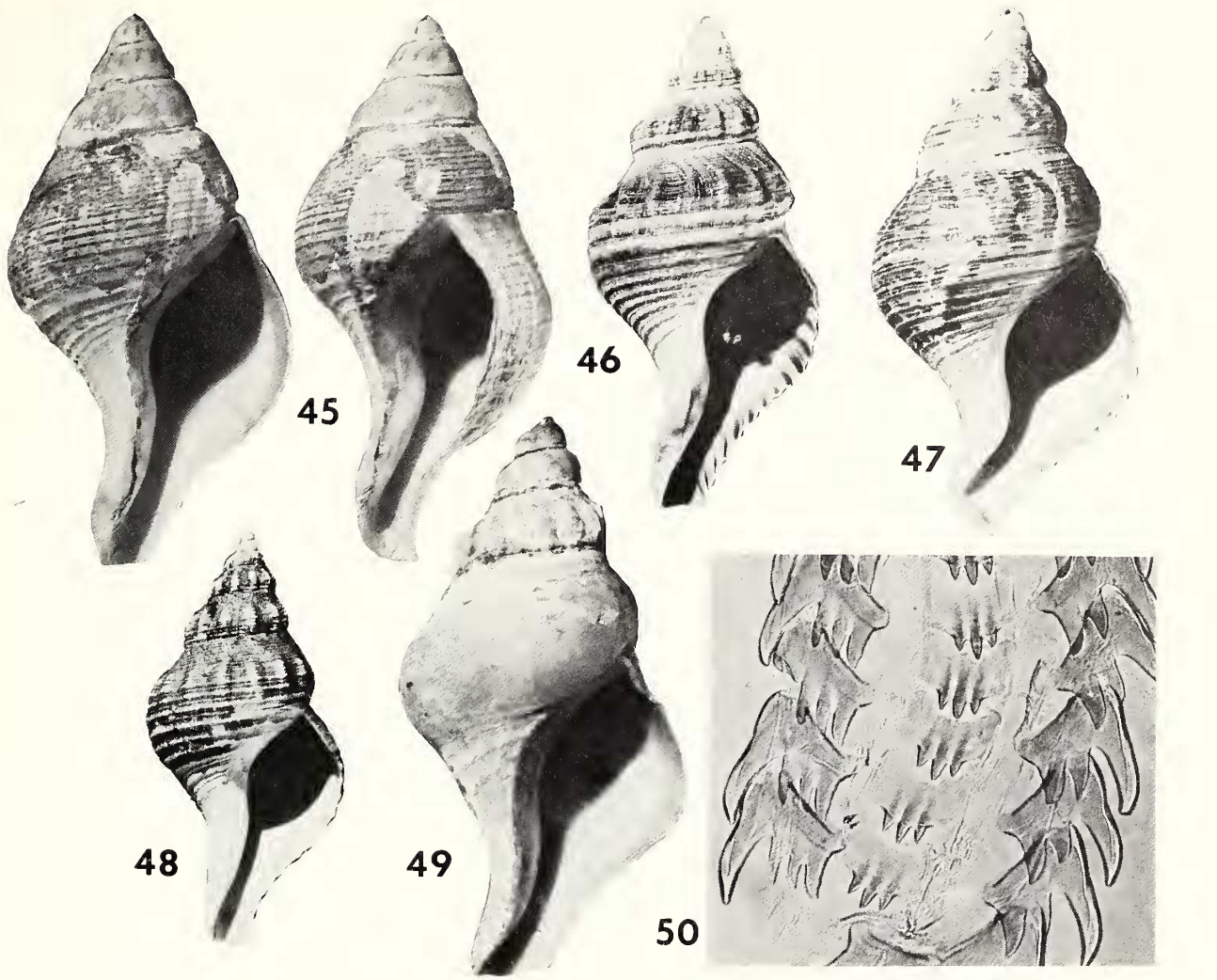
Cancellaria* (*Crawfordina*) *stuardoi **new species**

Figure 53

DESCRIPTION. Shell large, thin but sturdy, light brown under a thin but persistent light brown periostracum; whorls six, convex and slightly shouldered, suture deeply impressed. Protoconch lost; sculpture eroded on first two whorls. Axial ribs 18 to 20 per whorl, except on the final half whorl, where the ribs become more irregular and tend to be more broadly spaced from growth pauses; ribs crossing the whorls completely; ribs narrower than the interspaces; ribs posteriorly flexed near the suture. Spiral sculpture of broad, low ribs with more or less equal interspaces, 9 on the penultimate whorl and about 20 on the body whorl; spiral cords somewhat indistinct on the shoulder and narrower near the columella. Aperture ovate, columella incurved, columellar callus thin, parietal callus not thick enough to obliterate the sculpture, the anterior end of the columella consisting of a curved fold; two oblique folds higher on the columella, the posteriormost the largest, the folds hardly showing on apertural view, but much stronger within (shell viewed obliquely). Outer lip thin, lirate within. Operculum lacking.

Dimensions: height 61.3 mm, diameter 31.5 mm (holotype, Fig. 53); height 62.9 mm, diameter 31.0 mm (paratype); height 57.5 mm, diameter 30.8 mm (paratype).

MATERIAL. Chile: Coquimbo, Papudo, Pichilemu (LACM, type lot, Fig. 53).



Figures 45 through 50, *Aeneator castillai* new species. **Figure 45,** two views of holotype, LACM 1986, 300 m off Papudo, Chile, height 78.7 mm. **Figure 46,** LACM 72499a, 400 m off Los Vilos, Chile, height 69.3 mm. **Figure 47,** LACM 72499b, same locality, height 75.7 mm. **Figure 48,** LACM 72499c, same locality, height 56.6 mm. **Figure 49,** LACM 61-12, 110 m off Coquimbo, Chile, height 79.8 mm. **Figure 50,** radula ribbon, LACM 72499, 400 m off Los Vilos, Chile, width of field 0.5 mm.

TYPE MATERIAL. Three specimens from the type locality collected by Andrade, 25 May 1976, unidentified shrimp trawler. Holotype, LACM 1988; paratype, MNHN 200493; paratype, MZICB 15.532. Each specimen has the soft parts separately preserved.

TYPE LOCALITY. 240–350 m off Pichilemu, Chile (34°27′S, 72°24′W).

DISTRIBUTION. Coquimbo (29°58′S), to Pichilemu (34°27′S), Chile. Depth range: 200–350 m.

DIAGNOSIS. A species of the subgenus *Crawfordina* characterized by its large size, high spire, convex whorls, and sharp clathrate sculpture. It is remarkably similar to the type species of *Crawfordina, C. crawfordiana* from California (Fig. 54). The latter species has a more fibrous periostracum, is somewhat more slender and smaller (attaining a length of about 50 mm), has a slightly more constricted tip to the canal, and has fine pustules on the anterior region of the columellar callus. Despite these differences, the two species are clearly related, having similar proportions, sculpture, and the columellar plications visible in oblique view. *Cancellaria io,* the third member of the subgenus, differs from both *C. stuardoi* and *C. crawfordiana* in having subdued spiral sculpture.

ETYMOLOGY. We are pleased to name this species in honor of Dr. Jose Stuardo of the Universidad de Concepción, Concepción, Chile.

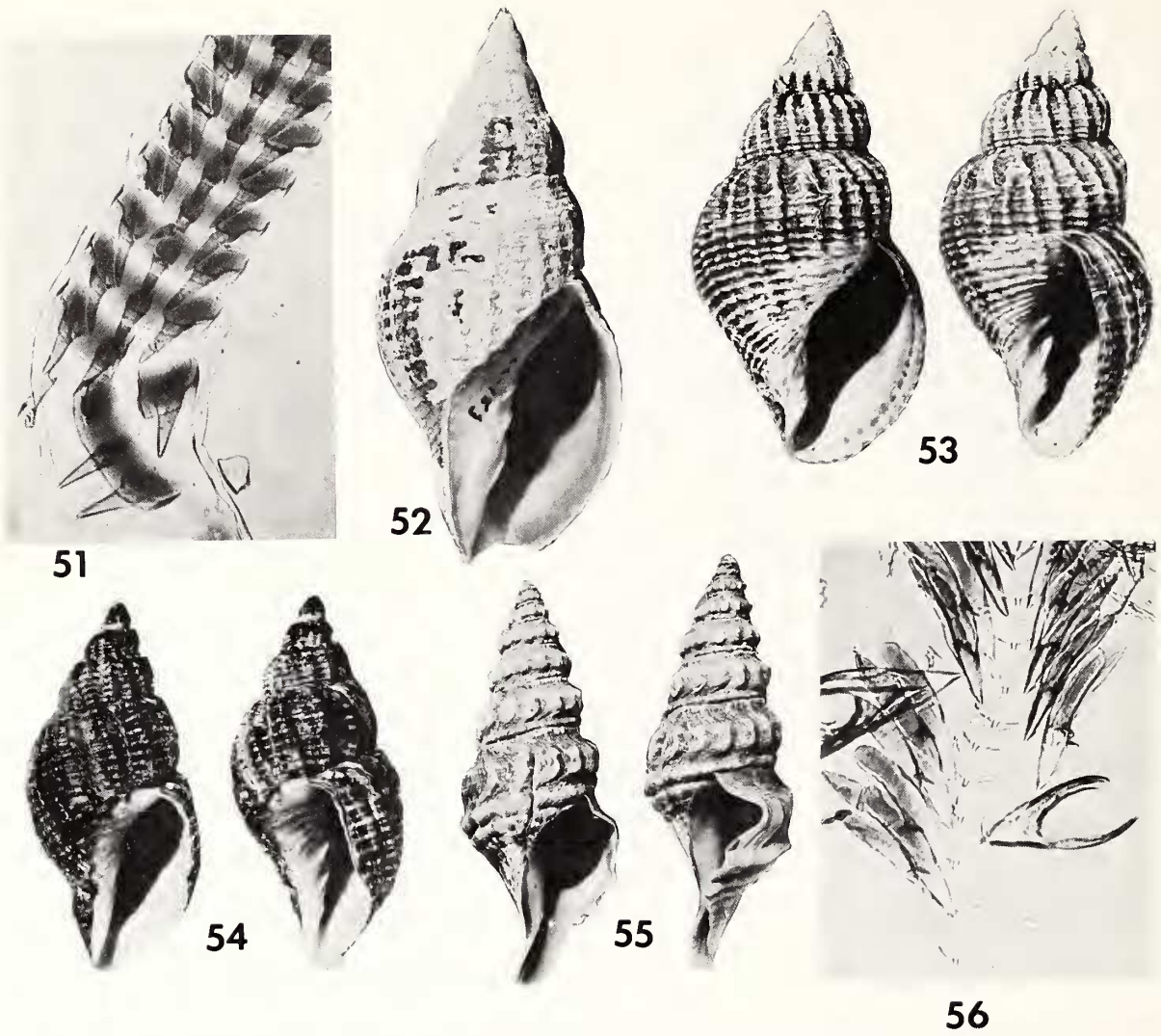
Superfamily Conacea

Family Turridae

Subfamily Turrinae

Genus *Ptychosyrinx* Thiele, 1925

Type species (original designation): *Pleurotoma* (*Subulata*) *bisinuata* Martens, 1901. Recent, East Africa.



Figures 51 through 56, *Miomelon alarconi, Cancellaria stuardoi, C. crawfordiana,* and *Ptychosyrinx chilensis.*

Figures 51 and 52, *Miomelon alarconi.* **Figure 51,** radular ribbon, LACM 73502, 200-400 m off Coquimbo, Chile, width of field 0.6 mm. **Figure 52,** LACM 66-153, 290-450 m off Cabo Carranza, Chile, height 74.9 mm.

Figure 53, *Cancellaria stuardoi* new species, two views of holotype, LACM 1988, 240-350 m off Pichilemu, Chile, height 61.3 mm.

Figure 54, *Cancellaria crawfordiana,* two views, LACM 72505, 50-100 m off Redondo Beach, California, height 49.8 mm.

Figures 55 and 56, *Ptychosyrinx chilensis.* **Figure 55,** two views, LACM 72506, 350 m off Pichilemu, Chile, height 42.4 mm. **Figure 56,** radula ribbon, LACM 72506, same locality, width of field 0.4 mm.

Ptychosyrinx chilensis is the only eastern Pacific member of its genus, a member of the subfamily Turrinae, in which the excurrent sinus is located at the peripheral keel (see Powell, 1966; McLean, 1971). According to Powell (1966), other species occur in the "deep ocean basins of the Indian Ocean, Natal, East Africa and the East Indies, the north Atlantic, off Bermuda." Hickman (1976) illustrated *P. chilensis* and recorded species of *Ptychosyrinx* from the Oligocene of Oregon.

Ptychosyrinx chilensis Berry, 1968
Figures 55, 56

Ptychosyrinx chilensis Berry, 1968:158; Hiekman, 1976:89, pl. 7, figs. 1, 6.

DESCRIPTION. Shell moderately large, length of aperture and canal less than half the length of the shell; color light brown under a fine brown periostracum; shoulder concave, growth line deeply sinuate, periphery marked by strong axial projections, about 15 per whorl; base with three strong spiral cords, the posteriormost retained just above the suture; fasciole with more subdued spiral sculpture.

Dimensions: height 42.4 mm, diameter 15.8 mm (Fig. 55).

Radula (Fig. 56): rachidian rectangular, unicuspid; marginals of "wishbone" type. This is typical for the genus as described by Powell (1966).

MATERIAL. Chile: Punta Mar Brava (LACM), Punta Hornos (LACM), Coquimbo (LACM), Punta Panulcillo (LACM), Bahia Navidad (LACM), Pichilemu (LACM, Fig. 55), Cabo Carranza

(LACM). Specimens examined: more than 100.

TYPE MATERIAL AND TYPE LOCALITY. Holotype, LACM 1912. Type locality: "about 200 fms.," (366 m) off Coquimbo, Chile.

DISTRIBUTION. Punta Mar Brava (29°21'S) to Cabo Carranza, Chile (35°27'S). Depth range: 65–400 m.

REMARKS. *Ptychosyrinx chilensis* resembles the type species of *Ptychosyrinx* but has stronger spiral sculpture on the base and lacks the sinuate projection of the lower lip of that species.

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